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Analytical Studies: Methods and References

The Measurement of Firm Entry in the Longitudinal Employment Analysis Program

by John R. Baldwin, Danny Leung and Len Landry

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.. not available for a specific reference period
... not applicable
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0^s value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p} preliminary
^{r} revised
x suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E} use with caution
F too unreliable to be published
* significantly different from reference category ($p < 0.05$)

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Economic Analysis Division

Statistics Canada

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Analytical Studies: Methods and References

Papers in this series provide background discussions of the methods used to develop data for economic, health, and social analytical studies at Statistics Canada. They are intended to provide readers with information on the statistical methods, standards and definitions used to develop databases for research purposes. All papers in this series have undergone peer and institutional review to ensure that they conform to Statistics Canada's mandate and adhere to generally accepted standards of good professional practice.

The papers can be downloaded free at www.statcan.gc.ca.

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Abstract

Understanding the importance of the dynamic entry process in the Canadian economy involves measuring the amount and size of firm entry.

The paper presents estimates of the importance of firm entry in Canada. It uses the database underlying the Longitudinal Employment Analysis Program (LEAP), which has produced measures of firm entry and exit since 1988.

This paper discusses the methodology used to estimate entry and exit, the issues that had to be resolved and the reasons for choosing the particular solutions that were adopted. It then presents measures that are derived from LEAP. Finally, it analyzes the sensitivity of the estimates associated with LEAP to alternative methods of estimating entry and exit.

Keywords: entry, measurement issues, LEAP

1 Introduction[1]

Markets are often characterized by continuous change—competition leads some firms to grow and others to decline. The amount of market share transferred in a typical Canadian industry from those declining to those who are growing is large (Baldwin 1995; Baldwin and Gu 2006; Baldwin and Lafrance 2011). This change causes ongoing renewal in industries. An important part of this turnover comes from the entry and exit of firms.

Entry is of interest for several reasons. It is seen as a barometer of the state of the economy. Dynamic economies experiment with new ideas and new processes, and constantly renew themselves. A significant source of renewal is the entry or the creation of new producers.

The Longitudinal Employment Analysis Program (LEAP) has been producing measures of entry and exit since 1988.[2] A detailed description of the tables published by the program and the files used are contained in Section 5. CANSIM tables 527-0001 to 527-0012, which are derived from LEAP for the period from 2001 onwards, are available on the Statistics Canada website.[3]

Analysts who use these data need a full discussion of methodological issues relating to the way entry is measured by LEAP and the nature of the decisions involved in the measurement process. Users also need to understand the sensitivity of the estimates to alternate approaches and definitions. The purpose of this paper is to summarize issues surrounding the way in which entry is measured in Canada in LEAP.

Since more than one definition of entry can be used to estimate the importance of entry in Canada, this paper attempts to provide some guidance to data users, especially those who use the data for studies that compare the turnover in Canada to that in other countries as to how entry rates vary when different approaches are used. It provides an estimate of the range or confidence interval that should be used in evaluating whether there are real differences in measured entry rates across countries.

The paper is organized around the following set of questions:

(1) When should a firm be counted as new and therefore an entrant?
(2) What unit should be defined as the production entity?
(3) What degree of independence in the production entity should be required to define it as new?
(4) What metric should be used to gauge the importance of entry?
(5) What type of size presence is required before the new entity is substantive enough to be counted?
(6) What degree of continuity should be embodied in the definition of a continuous firm as opposed to an entrant?
(7) Should the definition of a substantial presence require a degree of permanence?
(8) How should the issue of a false positive be treated in entry measurement?

The paper discusses the issues that each of these questions raises. It then outlines the choices made to measure firm entry in the Canadian business sector.

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1. For an earlier paper that examines the sensitivity of entry rates to different definitions and the use of different source datasets, see Baldwin, Beckstead and Girard (2002).
2. See Statistics Canada (1988) and Kanagarajah (2005) for catalogued publications by Statistics Canada containing data for earlier periods.
3. Other estimates over longer periods are available on request. See Macdonald (2014) for an example of estimates over longer periods.

This paper also aims to inform users of alternatives to the published base estimates that LEAP can produce. The estimates contained in the CANSIM tables that are derived from LEAP can be customized to suit a particular analytical need.

2 The magnitude of entry

Entry is at the heart of two quite disparate economic paradigms. On the one hand, new firms play a critical entrepreneurial role in economic activity (Knight 1921; Kirzner 1972). On the other hand, the traditional neoclassical approach portrays entry and exit together as one of the equilibrating forces that drive down above-normal profits and that equate price and average cost in an industry. Since entry plays a prominent role in both models, quantitative evidence on the importance of entry is required.

Initially, empirical studies of the entry process were restricted primarily to case studies (Mansfield 1962). With the advent of large micro-data bases, this has changed. Statistical agencies that computerized their files on firm populations during the 1970s and 1980s have published many studies that cover more comprehensive populations. Some of these databases originate from official statistical agency files that at first covered the manufacturing population (e.g., the Longitudinal Research Database of the U.S. Census Bureau). Other databases originate from private-sector sources, such as the longitudinal file that was developed at the U.S. Small Business Administration from Dun & Bradstreet records. Estimates of entry were developed in Canada from comprehensive Canadian micro-data files on manufacturing firms that were collected by the Census of Manufactures (see Baldwin 1995).[4]

In Canada, tax records now provide extensive coverage of the population of all employer firms both in the manufacturing sector and elsewhere. These records generate data on wages paid, number of jobs, and average employment (see Baldwin, Dupuy and Penner 1992). These data are linked to administrative data on the structure of firms, which are maintained on Statistics Canada's Business Register.[5,6] A longitudinal tracking number is then created to permit the study of various aspects of the dynamics of firms—entry, exit, growth and decline in the continuing-firm sector.

Before entry measures are constructed from the large micro-data bases that track the presence and activity of firms, several important questions need to be answered—questions about the correct conceptual measure of entry. These are discussed in the following sections.

2.1 When should a firm be counted as new and therefore an entrant?

The issue

Choosing a measure of the rate of entry of new firms requires an answer to the following questions. When should a new production entity be classified as an entrant? At what stage in the creation process should a firm be defined as having come into existence? When does a new firm move from the embryonic stage to the birth stage and when should a birth be registered?

4. Several Canadian studies that use manufacturing databases are listed in the "Further reading" section at the end of the document.
5. For more extensive discussion, see Lafrance and Leung (2010).
6. Also see Statistics Canada website on Definitions, Methods and Definitions, Longitudinal Employment Analysis Program (LEAP), at http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=8013&lang=en&db=imdb&adm=8&dis=2.

A new firm goes through several stages, any one of which could be used to define the point of entry. In its earliest form, a new firm may just be an idea in the mind of an entrepreneur, or a tentative experiment that may consist only of the founder working in a garage or home office. At a later stage, this entrepreneur may create a formal legal structure for the firm's activities. At another stage, the firm will acquire the factors needed to support production, either by acquiring physical capital assets or by beginning to hire employees. At another stage, it is incorporated into official business registers of tax authorities and/or submits administrative data to governments and becomes formally recorded for doing so. At still another stage, it is picked up in the records kept by statistical agencies of business populations and possibly surveyed by a statistical agency.

Any statistical program that measures entry needs to define the point in the firm-creation process at which the number of 'new' entities will be captured. There is no 'correct' time at which entry can be defined as having fully occurred.

One candidate that divides the population of embryonic firms from functioning entities is the existence of substantive concrete economic transactions. But even if the point of entry were defined as the first economic transaction, a decision would still have to be made on the type of transaction that would trigger the event being enumerated. This point could be the hiring of the first worker. In Canada, this requires a firm to file statements of account for current source deductions (PD7 forms) or income tax schedules for workers (statements of remuneration paid [T4 slips]). This point could also be when firms make their first sale and files sales-tax forms. Or it could be when a firm files income taxes on the T2 Corporation Income Tax Return (T2 form) for the first time. A new firm does not always file each of these forms at the same time.[7]

If the targeted population of entrants consists of all individuals who are just beginning to formulate ideas for establishing a new business, measures of the number of entrants will be different than if the targeted population covers only firms that have made a tangible commitment to lay the foundations by hiring workers to start operations. The earlier in the entry process that measurement occurs, the larger will be the number of entrants recorded by the statistical process. Far more people conceive of ideas for a new business (what is sometimes referred to as a nascent business) or create the legal underpinnings required to get a business started (e.g., legal structure, business license) than ever get to the stage of acquiring assets or hiring workers and beginning production.[8]

Not only will the number of new entrants that are reported by the statistical program be affected by the stage in the firm-creation process used for measurement, but so too will be the size of the entrant that is captured—since the size of most new entities, whether measured in terms of employees or assets owned, is generally inversely related to age. The earlier in the creation process that measurement occurs, the smaller will be the size of the average reported entrant.

In summary, the various databases that measure entry capture new firms at potentially different points in their initial development. Rather than argue that one point in time is preferable to another, it is better to clearly define the stage in a firm's development that is used in a particular statistical program to define entry, so that differences in levels of entry rates can be related to differences in the point at which a new firm is first captured. And it is often important to understand the nature of the statistical agency's collection systems to comprehend the life stage that is being used.

7. In Canada, firms are required to file PD7 forms on a sub-annual basis and T4 slips yearly. New firms would therefore be expected to file the former for their employees in their first year of operation and the latter in the following year. In reality, some of these firms only file T4 slips.
8. The number of entrants would be larger but the entry rate may not be, since the denominator used to calculate rates would now include a much larger population.

Solution adopted for estimating Canadian entry rates

Estimates of entry rates in LEAP use administrative tax files that Canadian businesses must remit to the Canada Revenue Agency (CRA) on the income paid to their employees and the income taxes deducted for them. This choice was made because of the comprehensiveness of the database—all employers are required to file T4 slips for their employees once a year. There are penalties for employers that do not do so, and there are consequences for employees who cannot complete their own tax filings easily without having received these documents.[9]

Each Canadian firm that files T4 slips is assigned an identification number. These numbers, along with other information on firm relationships, are maintained on Statistics Canada's Business Register of Canadian businesses.

An entry is defined in LEAP as the filing of a set of employment records in a particular year by an enterprise that did not do so in the previous year. That is, a new firm is one that did not file any T4 slips in the previous year or whose identification number did not exist in the previous year. The event that triggers the registration of a new firm in the entry database, then, is the employment of workers.

2.2 What unit should be defined as the production entity?

The issue

Studies of the dynamics of entry focus on the extent to which the entities operating in the economy are being renewed. But economic entities are complex in that they often operate together as a family of production units. That means that statistical programs must choose the level at which entry is defined.

Production entities exist at different levels in the production chain. At the lowest level are the individual locations where production occurs, which are sometimes referred to as establishments or locations. At a higher level are all establishments owned by a legal entity—for example, a corporation or an unincorporated business. At still higher levels are all legal entities controlled by a parent that is itself a separate legal entity—what might be called the ultimate parent.

Entry can be defined using entities at any of the above stages or levels. The lower the level (i.e., plants as opposed to firms), the larger will be entry counts. A new plant is not necessarily associated with the creation of a new legal entity. Therefore, entry counts will differ if plants are used, as opposed to legal entities. Moreover, there are different levels of legal entity with the ultimate parent being the most comprehensive in that it may own numerous legal entities. Entry counts of legal entities will be higher than entry counts of ultimate parents who can own multiple legal entities.

No single choice will suit all analytical users. For those who want to know renewal rates at the location or production level, plant entry counts are required. For those who want to track the evolution of diversified mega corporations, data on new ultimate parents are important. For those who want to assess measures of new firms that involve something between an establishment and a conglomerate, a meaningful middle ground must be chosen.[10]

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9. Canadian firms also file sub-annual information on employees (PD7s) related to deductions for employment insurance and pension deductions. However, these files are not as complete as the T4 files and are therefore not currently used directly by LEAP to measure entry. When Statistics Canada receives the PD7s, the process to incorporate any new firms into the Business Register begins. These files are now being used to develop methods of projecting entry rates from LEAP, which are only available with a two-year lag, because of the delays in generating a fully processed T4 file that can be used to produce the LEAP estimates. See Leung (2014) for more information.
10. See Baldwin, Beckstead and Girard (2002) for a comparison of rates across different levels of the production process for manufacturing.

Statisticians therefore face two challenges: deciding on a meaningful concept and then measuring it. The procedure used to measure entry may involve a compromise between optimality and practicality. Whether alternate measures can be estimated, or estimated with acceptable quality, depends on the type and quality of information contained in business registers, which attempt to track the webs of ownership that connect firms. In some cases, connections between production entities occur simply through ownership of multiple entities by the same individual, and these generally cannot be tracked through the maps of corporate structure that are publicly available.[11]

Solution adopted for estimating Canadian entry rates

The appearance of an enterprise that files a T4 slip for the first time is used at the first stage in the definition of an entrant in LEAP. The Canadian entry rates focus on the legal entity defined as the 'enterprise' in the Business Register. This entity basically corresponds to the lowest level of the production entity that reports a complete set of financial accounts that allow revenue, costs and profits to be tabulated.[12] In practice, this is a legal entity that files corporate taxes with the tax authorities. It is also at this level that a separate definable legal entity generally exists.

The first-level legal entity is chosen for the analysis because it provides the basic building block upon which firms organize themselves for reasons that are meaningful to the business community. Financial statements are an essential part of the control process within firms. The first level at which these statements are produced is the organizational unit used by industry.

LEAP does not use data on new establishments that could be derived from new establishments that appear on the Business Register to measure its base entry statistics for two reasons. While data on establishments below the enterprise level are available from Statistics Canada surveys for some industries, such as manufacturing, they are not available from survey sources for a broad cross-section of industries. Data are available on the Business Register for many establishments, but the estimates on the Business Register below the enterprise level (revenue and labour) are often modeled and therefore are less precise than the data available at the enterprise level that come directly from the tax filings of firms. More importantly, for much of the period during which the entry estimates have been produced (since 1988), the data attached to the Business Register for establishments were only updated with a lag and did not offer the same timeliness as the employment data derived from the T4 slips of the firms themselves to the CRA.

In addition, the business enterprise is used as the unit for entry analysis rather than the higher ultimate-parent level because the business enterprise is associated with the corporate tax filing system and therefore has the type of comprehensive coverage of the business population that is needed. The CRA and Statistics Canada assign business identifiers in a comprehensive fashion to develop databases on tax filers that link employment data to accurate profiles of firm structure at the level of the legal entity (the enterprise). By contrast, while additional information on firm structure sometimes allows the ultimate parent to be identified, this information has not been central to the Business Register and does not currently have the quality required to make this the focus of the analysis.

11. This emphasizes the trade-offs that must be made between conceptually desirable variants of entry measures and those that can be reasonably achieved with existing measurement systems. If the highest level of parent firms is likely to be least well measured because of such difficulties, imposing rules that use this level will introduce imprecision in the estimates.
12. See the Statistics Canada website reference mentioned in Footnote 6 for the definition of an enterprise.

2.3 What degree of independence in the production entity should be required in order to define it as new?

The issue

Information about the economic activity in different levels of production entities is useful for different purposes. Knowledge about the entry of new ultimate parents is different from information about how many new legal entities are created, at least when an ultimate parent controls legal entities in different industries. If a parent creates a new legal entity for a new business line in a particular industry, knowledge that this has occurred is essential for studies at the industry level. Similarly, it is important to focus counts at the level of actual production facilities if researchers want to draw conclusions about renewal at that level.

Producers are connected in different ways. Some are owned by other firms. Others stand as independent entities with no ownership ties to existing entities in the same country or to legal entities elsewhere. Still others may be connected to other entities in more complex ways, such as a common set of directors.

Some studies of entry may be concerned with measuring only new units that stand separate or independent from other entities. In this case, a decision has to be taken on the degree of independence that must exist before a new entity is sufficiently independent to be classified as an entrant. If so, information has to be obtained on questions such as "Can the new entity exist on its own and make decisions across a wide enough spectrum of activities to be considered independent?"

Unfortunately, it is difficult to obtain this information about many firms. Cross-ownership links may still leave managers with substantial independence, at least in the industry within which they operate.

An intermediate standard may be used instead of a standard that considers all ownership links at the ultimate-parent level. An intermediate standard only considers other closely associated legal entities within a narrowly prescribed radius, such as an industry or geographic area. This standard would define firms that are 'close' either in a geographical or industry sense.

If the industry is used to prescribe a unit of similarity that will define independence, new entities would be defined as new separate legal entities operating within the same industry. This would define a new firm as a new legal entity with no ownership links to other firms within the same industry, but would allow it to be owned by a parent who operates other firms in other industries. If geography is to be used as the unit of distance, new firms would be those with no ownership links to other firms in the same geographic area.

LEAP has been created as a database with a number of identifiers for region, industry or nature of the firm that enable the creation of estimates using these proximity factors that supplement those of the base program in a number of the dimensions discussed above. Without these nuances, and using a definition that excludes as possible entrants all new legal entities that are connected with other legal entities, entry statistics would exclude a large number of events. These excluded events are nonetheless associated with change and with the emergence of new production entities, and many users of these statistics find them useful.

Solution adopted for estimating Canadian entry rates

The entry rates reported by LEAP focus on the enterprise (or the legal entity that generally corresponds to the lowest unit reporting corporate taxes, financial flows and asset data). These entities, despite being occasionally owned by parents with production interests elsewhere, have

sufficient independence to make this a base for the program that will appeal to a broad cross-section of users.

However, the program also has flags to identify the nature of the enterprise (i.e., links to parents), thereby giving it the flexibility to reshape its estimates for users that require slightly different definitions. For example, the estimates can be modified to apply only to new production entities without a pre-existing ultimate parent. Or they can focus on new legal entities at the provincial level that have a parent with operations elsewhere in Canada in a previous year. The latter definition has proven more useful to many provincial users of data than the definition that excludes these entities from provincial entry statistics, and it is used in LEAP to produce entry rates for individual Canadian provinces (see Baldwin, Liu and Wang 2013).

2.4 What metric should be used to gauge the importance of entry?

The issue

The importance of entry can be gauged either by counts of physical entities or by the size of the entrants. Counting physical entities alone has the disadvantage that these measures may not capture aspects of the importance of the entry process if the impact of entry partially depends on the size of the entrant.

Even after decisions are taken as to whether the count or the size metric is used, there are still choices as to the unit of measurement in each case.

If counts of entrants are being used, it must be recognized that these counts will vary depending on the production unit that is being used. The number of new entities at any point in time will be inversely related to the level at which producers are defined, that is, whether it is at the lowest level (an establishment) or a higher level (the legal enterprise). There are more establishments than legal entities and there are more legal entities than ultimate parents, since legal entities can own multiple establishments and an ultimate parent can possess more than one legal entity. Therefore, the number of entrants will be larger when establishments are counted than when ultimate parents are counted. The standard solution to this phenomenon is to compare the number of entrants to the population that is being renewed so as to create a rate of entry—defined as the ratio of the number of entrants to the total population of production entities.

If size measures are used in order to gauge the importance of entry, it must be recognized that alternate candidates are available to measure the size of an entrant. Employment provides a dimension that allows users to evaluate the impact of the new entity on labour markets. Measuring entry in terms of new jobs, relative to total jobs, can be useful for analysts interested in the contribution of new firms to the provision of jobs, for instance. If analysts are interested in the final product market, measuring the importance of new entities in terms of sales provides measures of market share captured by entrants. These measures are often used in industrial economics to describe the market power of an entity.

Solution adopted for estimating Canadian entry rates

The entry rates derived from LEAP count all new firms that file a T4 slip indicating that they have employees. This is done because the primary users of the data need information on how firm dynamics affect labour markets. Accurate information on this topic requires measuring employment. The micro-data include information on the number of employees, and the files can be edited to remove the units that users deem to be unimportant. But the official statistics do not distinguish between important and unimportant entrants in terms of the size of employment provided, because there is a lack of consensus or evidence on what that boundary should be.

Different measures of employment are available from LEAP, but only one is chosen for published tables. A measure of the number of people with jobs during the year, or individual labour units (ILUs), is estimated but not used in the public tables.[13] Employees that have multiple jobs are allocated across firms in proportion to their wages. While this measure avoids double counting workers, it does not take into account whether the job is well paid or full time. The measure that is used in the published statistics is an average labour unit (ALU). An ALU is a measure of employment derived from the wages paid to employees divided by the average wage of those employed in firms in the same industry and region, and of the same size. As such, the measures capture the amount of employment if firms were paying their workers an average wage and employing them for the same duration as other comparable firms. While it is not a full-time equivalent count, it can be thought of as a 'normal' equivalent count.[14] These measures are, in turn, benchmarked to job counts derived from the PD7 files that count employed workers per month. The Labour Statistics Division of Statistics Canada uses the PD7 data to produce monthly estimates of employment. Therefore, the labour measures derived in the entry program can be compared to employment totals that are used elsewhere in the agency. This allows the impact of entry to be calculated in terms of an employment measure that is produced elsewhere. This creates a meaningful point of comparison and provides for coherency, an important quality standard in products of statistical agencies.

2.5 What type of size presence is required before the new entity is substantive enough to be counted?

The issue

Analysts studying firm dynamics are often interested in new firms because of the possibility that they will transform the industry by having an effect on competition or by supplying the market with viable alternatives to products or services provided by existing firms. New firms that are insignificant are less likely to provide substantive alternatives or compete with incumbents in the short run.

As a result, statisticians are faced with decisions about whether to apply thresholds to filter out some new firms that might be considered chaff. This somewhat emotive term is deliberately used here to indicate the difficulty of the task. Since all existing substantive entities started from nothing, the application of a size filter will remove some of these more successful entrants.

There is little to guide statisticians on the appropriate type of size filters. Dollar limits can eliminate firms with sales or assets below a certain value. But such limits are essentially arbitrary and need to be adjusted over time to take into account changing price levels.

Applying a cut-off limit to the number of employees appears at first glance to solve the problems with choosing a moving target, if the limit is at least one employee. But applying this limit still requires choosing the time period to which it applies. Should it be any time during the measurement period (e.g., a year, a quarter, or a month)? Or should it be over the entire time period? For an annual estimate, a type of monthly average could be used.

Finding answers to these questions inevitably raise more questions about the quality of the job created in the entrant. Should the measure of employment be a full-time job with an average number of hours? Should it be a job that pays at least an average wage? Here, decisions must be made about how to assess the quality of the jobs being created, and these decisions carry the measurement of entry into new domains. Whether it be a size or a quality issue, thresholds are essentially arbitrary.

13. This count comes from the T4 files.
14. It would be a full-time equivalent count if full-time were defined as the normal amount worked.

Solution adopted for estimating Canadian entry rates

The Canadian entry rates associated with LEAP define entry as the arrival of a new entity with any employment in the form of ALUs. New entrants may be associated with less than one ALU. This would occur if a new small entrant operates for less than one year, employs part-time workers or pays less than an average wage rate.

Positive employment is used as the metric, since LEAP focused initially on the impact of the creation of new firms on labour markets. However, the program has evolved to incorporate more characteristics than just employment. To more fully delineate the origins of new firms, the program allows extensions that measure new firms with assets but no employees, new firms with neither assets nor employees, or new firms with only working owners that pay themselves a wage. The extensions to the program can also provide a richer picture of the origins of enterprises in the Canadian economy in response to special requests.

2.6 What degree of continuity should be embodied in the definition of a continuous firm as opposed to an entrant?

The issue

Studies of firm dynamics divide firms into continuers, as opposed to those who are discontinuous—new firms and exiting firms. At issue is how this distinction is defined—or when a firm that continues its legal existence but shuts down and reopens periodically should be counted as an exit and an entrant during these episodic lapses in production.

The problem arises because some production entities stop and then restart operations but for all intents and purposes are incumbents—either in terms of legal status, or product offering. When one of these incumbents reappears in administrative registers after reopening its plant, the 'new' production entity may not necessarily be new in many important dimensions. For example, it may not be associated with a new legal entity, and its employees may not necessarily be new if they have been recalled. There may be no new buildings and machinery, if previous assets that are idle are simply restarted. This particular issue is more important in economies with pronounced seasonal fluctuations, because they have a different periodicity than the measurement cycle used by a statistical agency.

Solution adopted for estimating Canadian entry rates

The LEAP practice here is to define entrants as firms that had employees in year t but not in the year before (year $t-1$). This will include some entities that hire employees in year t but that had existed and had employees at some time in the past prior to $t-1$.

This is done for two reasons. First, this definition captures entities that start hiring for the first time and those that start hiring after at least one year's hiatus with no employees. The definition covers both types of hiring, since the entry data are primarily used to study labour markets, and both clearly create jobs that were not there in the previous year. Second, examination of entities that emerge from a hiatus suggests that a break of at least two years brings about sufficient changes in the underlying entities that they are better classified as new than as continuing.[15]

15. A clerical review of enterprises returning from such a hiatus shows that these firms may change addresses or product lines (Baldwin 1995).

2.7 Should the definition of a substantial presence require a degree of permanence?

The issue

Ephemeral firms may be considered to have little impact on the renewal of markets. The rapid disappearance of new firms immediately after they have been created may mean that incumbents never have to react to the presence of new competitors, because firms who leave immediately after entry may have no transformational impact on the markets they fail to penetrate.

New firms have high failure rates (Baldwin et al. 2000). Some firms never get beyond a vague idea in the mind of someone who is self-employed. Others start but fail within the first year. Others last only a year and then disappear. Still others last longer—but, by the age of 10, almost 80% of a cohort of new entrants in Canada has disappeared (Baldwin et al. 2000, Tables 3 and 4).

Since the exit process takes place almost continuously from the point of creation, any definition of permanence needs to argue for a particular age of maturity. Several alternatives are available. The first is to simply remove all entries that are extremely short term. The definition of 'short term' depends on the frequency with which entry is measured in different databases. If entry is measured annually, then the shortest term available is one year. In this case, entry counts that omit the most ephemeral of new units could be defined by counting new firms that last to a second year.

If the goal is to remove all firms except those that make it to a point of maturity, then statisticians need to define what that point is in the life of a firm. Baldwin et al. (2000, p. 69) suggest that entrants become more like continuers in a number of respects by about their fifth year. If that is the case, entrants could be defined as all firms that last five years.

While it is possible to devise filters to remove some new firms based on future performance, any such attempt reduces the timeliness with which entry statistics can be produced. If entry is restricted to firms that survive until a specific future period, the entry rates for a particular year cannot be finalized until data for these future years become available.

Solution adopted for estimating Canadian entry rates

The published Canadian entry rates derived from LEAP do not take into account future success. But background papers have estimated the extent of the impact on annual entry rates of reducing the published rates to take this factor into account. For example, Ciobanu and Wang (2012) report that the average entry rate in the Canadian business sector between 2000 and 2008, using the number of enterprises, is 10.8%. If all short-term entrants (those that do not last to the next year) are removed, then the rate falls to 7.5%. Removing short-term entrants has less of an impact when using employment as a metric. The same annual average falls from 1.9% to 1.6%.

The impact of including only new firms that survive beyond the year of creation is addressed more fully by Baldwin, Beckstead and Girard (2002). By counting only new firms that last to a given point in the future, they calculate what might be classified as a longer-term entry rate—the rate associated with firms that have some permanence. Over the period from 1989 to 1997, the average annual entry rate derived from enterprise counts was 14.5% using the LEAP files. The average five-year entry rate (counted using only the enterprises lasting through to their fifth year) was just 5.0%—one-third of the one-year rate. When employment is used to calculate the entry rate, it falls from 2.5% to 1.3%.

The practice then of LEAP has been to provide an entry rate that includes all newcomers and to supplement these data with studies that examine the proportion of the total entrant population that is short-lived, using a range of definitions of shortness of life.

2.8 How should the issue of a false positive be treated in entry measurement?

The issue

Many factors cause a new entity to appear in the databases that measure entry. The starting point for most estimates is the appearance of a new firm identifier in these databases. Unfortunately, the creation of new identifiers in administrative databases may not always correspond to the concept desired for analysis.

The creation of a new firm in LEAP is closely bound to the issuance of a new business registration number for the enterprise. But the issuance of a business number may not always correspond to the emergence of a new firm. This problem arises when the measurement system provides what can be termed a false positive.

In some cases, the issuance of a new business number is triggered in these databases by the appearance of a brand new firm that arrives in an industry by building new plants—what is often referred to as 'greenfield' entry. In other cases, it is brought about by organizational changes, such as mergers—what could be called 'entry by merger' or a 'brownfield' entrant. Units that existed separately in one period may merge and appear as one production entity in a subsequent year. While something new has been created, these new units are different from greenfield entrants in the sense that they have some previous existence and experience. Moreover, the original units are likely to have employed workers, so the employment reported in the new unit does not make the same contribution to new job creation as does employment in brand new firms. This distinction is important, since Baldwin (1995) reports that greenfield entry and merger entry are of about equal importance in the Canadian manufacturing sector. Including new units that are associated with mergers in entry counts doubles the rates of entry over just those that are produced by data that purely measure greenfield entrants—at least in manufacturing.

Business registers differ not only with respect to comprehensiveness but also with respect to continuity. They are often designed to provide an accurate snapshot of a cross-section of the population for a particular year that is adequate for sampling purposes, but not of the complete population,[16] nor of links between firms over time.[17] As a result, business identifiers in business registers can change over time for administrative reasons. And while a business register may indicate predecessor and successor relationships, this may not be done comprehensively. Maintaining time series may not be the primary focus of the register, and its comprehensiveness may vary over time in direct relation to budget constraints faced by the agency. As a result, business identifiers for a continuing firm can sometimes change even though the continuer has not. This event is another reason for the existence of the possibility of a false positive when entry is measured only by the appearance of a new identifier in administrative databases.

Solution adopted for estimating Canadian entry rates

LEAP then has decided to eliminate false positives linked to the reorganization of firms from entry rates. Reorganizations are important because they generate new entities, but these new entities are different in terms of their effect on labour markets. Therefore, they are not included in the core entry statistics, which focus on the impact of entry on employment. Moreover, the methodology developed to identify and therefore to eliminate the false positives associated with mergers has the advantage of then being able to measure the impact of mergers on turnover directly.

16. Micro firms are sometimes deliberately missed because their absence has little impact on totals of variables such as employment or revenues.
17. This is particularly the case when the purpose of the business registers is primarily to provide frames for sample surveys.

Several methods are used to eliminate these false positives. The Canadian longitudinal file derived from tax records tracks workers over time to correct for the creation and disappearance of firms that just arise from organizational change (Baldwin, Dupuy and Penner 1992). Workers in units that disappear from administrative records are compared to the workers in new units. Using decision rules that vary by industry and size of firm, records are linked where there is evidence that a large percentage of workers in the disappearing unit can be found in the newly created unit. This process is supplemented by name and address matches to correct for false entrants.

3 Sensitivity of estimates to alternative approaches

Data users require not just explanations of the methodology used to calculate entry but also how much particular assumptions embedded in the estimates affect the results. This section provides a sensitivity analysis for the main estimates derived from LEAP.

The data for the benchmark estimates of entry come from LEAP and are generated using the assumptions outlined previously. LEAP produces an administrative file that has at its foundation the Business Register, which maintains a complete file of firms, their structure and their industrial classifications. LEAP links new firms on the Business Register to administrative data from T4 slips filed by firms containing wages paid to employees. New firms in the LEAP file are new firms in the business sector that report employment earnings. For year t, they are enterprises that did not report employment earnings in year $t-1$. An enterprise is defined as the lowest level of legal entity that provides financial data.

The LEAP file is used not only to study entry and exit, but also to examine growth profiles of enterprises over time.[18] To serve the latter purpose, it must hold enterprise structure constant across time or be able to reconstitute it. For purposes of longitudinal tracking, analysts need to be able to track units of an enterprise in one period that are amalgamated or divested in another.

This requires that a consistent enterprise structure be present in the files. In order to do so, LEAP is reconstituted every year with the structure of the last year applied to previous years. This means that there are multiple files available for research. The number available corresponds to the number of years during which LEAP has been functioning. These files are referred to as vintage sets of histories of the business sector. The vintage for year t allows the study of firm dynamics from the start of the program up until year t.

As a result, entry in a particular year can be studied using more than one vintage (dated by the last year and covering all previous years). Changes between $t-1$ and t can be examined using the file constructed in year t or in any year beyond t, such as $t+1$. The structure of enterprises in the first file corresponds to that of year t, and in the second file to that of $t+1$. Differences occur between the files because the structure of firms changes over time as new units are acquired and old units divested.[19] Each vintage can be used to generate a time series on entry that defines entry consistently from the beginning of the time period to the year of the vintage.

To evaluate how different methods of calculating entry affect the standard estimates, various alternatives are presented here. These alternatives consider how the estimates of the importance of entry are affected by the use of different vintages of LEAP, by different assumptions of

18. A sample of research studies that have been produced using the LEAP file can be found in the "Further reading" section at the end of the document.
19. As a result, the total number of firms for a given year can legitimately change over time. For example, if the number of firms in year t is m when measured in year t, it could be $m-1$ when measured in year $t+1$ if two firms that were separate in year t merge by year $t+1$.

continuity, by different assumptions about the unit being measured, and by the use of different measures of employment. Tables 1 and 2 present the estimates. Table 3 defines the variables.

All alternative estimates presented here examine the amount of entry in 2011. Entrants are defined as new enterprises in year t that did not have employees in year $t-1$. Two vintages of the file are used to identify these enterprises. The first is the file created in 2011, which uses the structure of enterprises in 2011. The second is the file created in 2012 that uses the structure in 2012 to estimate the number of enterprises in 2011, and the number of new enterprises in 2011 compared to 2010.

Table 1
Measures of entry, 2011

Entry type	Firms	Entries	Entry rate	Entry measured by employment: ALU employment creation rate	ILU employment creation rate	ALU 2011	ILU 2011	ALU 2012	ILU 2012	BR employment	Monthly average PD7	Annual PD7
	numbers			percent					numbers			
One-year entry	1,066,451	138,506	13.0	1.5	2.3	166,580	305,671	262,475	378,678	130,932	235,252	138,428
Two-year entry	1,066,451	107,860	10.1	1.3	1.9	147,340	258,774	262,475	378,678	...	214,572	126,482
Short-lived entry	1,066,451	30,646	2.9	0.2	0.4	19,240	46,897	0	0	...	20,680	11,947
Previously active excluded	1,066,451	124,221	11.6	1.3	2.1	150,488	277,297	247,819	355,144	...	220,805	127,594
Ever previously active excluded	1,066,451	110,596	10.4	1.2	1.9	139,007	256,260	235,158	334,747	...	208,963	121,396
One year with no pre-existing UP	1,066,451	109,267	10.2	1.2	1.9	135,656	251,905	230,675	329,333	...	205,335	118,715
Previously active excluded with no UP	1,066,451	109,237	10.2	1.2	1.9	135,569	251,828	230,608	329,265	...	205,285	118,671
Ever previously active excluded with no UP	1,066,451	109,186	10.2	1.2	1.9	135,507	251,750	230,531	329,173	...	205,234	118,652

... not applicable

Notes: These measures cover all two-digit industries from the North American Industry Classification System, excluding those in the 61 (educational services), 62 (health care and social assistance) and 91 (public administration) categories. The entry year is 2011. For the definintions of the entry types and measures, see Table 3. ALU: average labour unit; BR: Business Register; ILU: individual labour unit; PD7: PD7 forms (statements of account for current source deductions); UP: ultimate parent.

Source: Statistics Canada, Longitudinal Employment Analysis Program, 2012.

Table 2
Alternate employment measures for the total business sector, 2011

	Average labour unit	Individual labour unit	Business Register
		numbers	
Employment	11,393,718	13,359,476	14,783,002

Notes: These measures cover all two-digit industries from the North American Industry Classification System, excluding those in the 61 (educational services), 62 (health care and social assistance) and 91 (public administration) categories.
Source: Statistics Canada, Longitudinal Employment Analysis Program, 2012.

Table 3
Names and definitions of entry types and entry measures

Names	Definitions
Entry types	
One-year entry	Zero average labour units (ALUs) in 2010 and non-zero in 2011.
Two-year entry	Zero ALUs in 2010 and non-zero in 2011 and 2012.
Short-lived entry	Zero ALUs in 2010, non-zero in 2011, and zero in 2012.
Previously active excluded	Exclude entry if non-zero ALUs in 2009.
Ever previously active excluded	Exclude entry if non-zero ALUs in any year prior to 2010.
One year with no pre-existing UP	Zero ALUs in 2010, non-zero ALUs in 2011, and ultimate parent (UP) in 2011 did not exist in previous years.
Previously active excluded with no UP	Exclude entry if non-zero ALUs in 2009 or if UP exists prior to 2010.
Ever previously active excluded with no UP	Exclude entry if non-zero ALUs in any year prior to 2010 or if UP exists prior to 2010.
Entry measures	
Firms	Total number of active firms in the entry year.
Entries	Number of entering firms.
Entry rate	Number of entries divided by number of firms.
ALU employment creation rate	Average labour units (ALUs) of entrants divided by ALUs of all firms.
ILU employment creation rate	Individual labour units (ILUs) of entrants divided by ILUs of all firms.
ALU 2011	ALU in 2011 for the entrants.
ILU 2011	ILU in 2011 for the entrants.
ALU 2012	ALU in 2012 for the entrants.
ILU 2012	ILU in 2012 for the entrants.
BR employment	Employment of entry firms based on the Business Register (BR).
Monthly average PD7	Employment of entrants in entry year from PD7 forms (monthly average divided by months in operation).
Annual PD	Employment of entrants in entry year from PD7 forms (sum of monthly employment divided by 12).

Notes: These definitions refer to the entry types and measures shown in Tables 1 and 2. The PD7 forms are statements of account for current source deductions.
Source: Statistics Canada, Longitudinal Employment Analysis Program, 2012.

3.1 Counts of entry and entry rates derived from these counts

The entry rate in 2011 using counts of enterprises is 13.2% for the 2011 vintage and 13.0% for the 2012 vintage. There is very little difference, at least between vintages that differ by only one year. The 2012 vintage will be used for the remainder of the paper.

The base definition considers all new enterprises in 2011, no matter how fleeting their life. To assess the impact of removing the least successful entrants, all firms that last only one year are removed to create a two-year entry rate. The group of short-lived firms consists of 2.9% of enterprises (the "short-lived entry" category in Table 1), and its removal would reduce the 13.0% entry rate to 10.1% (the "two-year entry" category).

The base entry estimate focuses on new enterprises that affect the labour market by hiring workers in 2011 but not in 2010. Firms that may have been active in the past are removed from the estimate to examine the impact of removing these entrants. The first alternative examined here eliminates enterprises that had a one-year hiatus, in that they had workers in 2009, did not report employees in 2010, and then hired workers again in 2011 (the "previously active excluded" category in Table 1). Removing these enterprises reduces the entry rate from 13.0% to 11.6%. The second alternative eliminates enterprises that had any employees at any time in the past (the "ever previously active excluded" category). This reduces the 13.0% entry rate to 10.4%.

Instead of modifying definitions based on continuity of presence, the population of new entrants in a given one-year period can be narrowed down to just those without an ultimate parent that was attached to any entity in the past. This will, for example, eliminate a new legal entity that enters a new province if its ultimate parent has a presence elsewhere in Canada, or an enterprise that enters an industry in which its parent does not have a presence. When this is done, the 13.0% entry rate is reduced to 10.2% (the "one year with no pre-existing ultimate parent" category in Table 1).

If in addition the continuity filter is applied so as to exclude firms with an ultimate parent the number of entrants is reduced by a further 30 firms, leaving the entry rate slightly reduced (the "previously active excluded with no ultimate parent" category in Table 1). The effect of excluding firms with an ultimate parent that were ever previously active, has a similarly minor impact (the "ever previously active excluded with no ultimate parent" category).

It is apparent that the filters for previous activity and for not having an ultimate parent elsewhere have about the same, and somewhat overlapping, effect on the measured entry rate. What begins as an estimate of about 138,000 new enterprises per year is reduced to about 109,000, or a reduction of about 21%. These filters reduce the instantaneous entry rate measured with a count of enterprises from 13% to around 10%. Most of this reduction is accomplished by eliminating all entrants in year t that were not present in $t-1$ and that can be found at some point in the period prior to $t-1$. Some 20% of the entry count data then consist of firms that might be referred to as intermittent operators. About the same percentage can be said to be very short-run participants—firms that enter and depart by the next period (short-lived entry). Both of course nevertheless provide employment in year t and should be counted if the full impact of entry on labour markets is to be tracked. But, for specific research studies of the dimensionality of the entry process, these and other additional dimensions provide useful information and can be isolated.[20]

20. An additional dimension that has served as the focus for other studies is the long-run impact of a particular cohort of entrants, which takes into account the survival curve as well as the growth profile of a particular cohort.

3.2 Employment data

Comparisons of entry rates are also made using employment data, because employment is the metric used in LEAP to measure the impact of entry or its importance.

Employment measures differ across administrative files. As already described, the employment measure in LEAP (the ALU) is essentially a normal-employment equivalent. It is created by dividing the wages received by an estimate of the average annual wage for firms of the same size in the same industry derived from the Survey of Employment, Payrolls and Hours (SEPH) program. It is also benchmarked to the estimate derived from the count of jobs that comes from PD7s used in the SEPH program.

A count of T4 slips that employers issue to all their employees for tax purposes is also available. This count is higher than the number of people who are employed, because some employees have multiple jobs, each of which has its own T4 slip. LEAP produces a related job count (the ILU) using the T4 slips. This count is slightly lower than the total job count derived from a simple count of T4 slips. People who receive more than one T4 slip in the micro-data files are split between firms on the basis of their share of wages in different firms.

The total number of entrants in 2011 is 138,506, and they account for 166,580 ALUs and 305,671 ILUs in that year (Table 1). Some of these entrants exist for only part of the year in which they are created, and the yearly employment estimates reflect this fact. For some purposes, it might be argued that a measure of employment in the first year should take into account the fact that these figures would be larger if firms were measured over the full first year. Using the size of firms in the year after birth is one way of measuring this. This measure is 262,475 ALUs and 378,678 ILUs, an increase of 58% and 24%, respectively. The 58% increase is consistent with new firms being present on average for about half the year in their first year.

While these adjustments can be made, they do not represent the actual employment in the first year. Making these adjustments is equivalent to raising employment higher than it actually was. These adjustments are however relevant to a different question—what is the long-run impact on employment of a particular cohort of entrants? This can be better answered by looking at the performance of a cohort of entrants in subsequent years. Examining size in the second year is only one way of doing this, and probably not useful for many other questions. Since this issue has been investigated in other publications, it will not be investigated further here (see Baldwin 1995; Baldwin, Beckstead and Girard 2002; Baldwin and Gellatly 2003, Chapters 2 and 5).

A person–job count can also be derived from PD7s that employers file with the CRA on a monthly basis. To compare this estimate to the ILU count derived from the T4 slips, the LEAP file was linked to the PD7 files to generate a separate job count. Both measure person–jobs. The first file corresponds to person–jobs associated with the issuance of PD7s and contains duplicates for employees with more than one job across employers. The number of person–jobs derived from the T4 slips comes from a list of people who were issued the T4 slips for their work at a company. It also differs from the number of employees because some employees have multiple jobs across the company units that issue the T4 slips. The two counts also differ from each other because fewer firms issue PD7s than issue the T4 slips.

Two estimates of job counts for entrants are calculated from the PD7 file. The first is a monthly average calculated just for the months in operation. This is referred to here as the monthly average. The second is the sum of monthly employment divided by 12. For units that operate for less than a year, the first gives an average that is comparable to an ALU estimate for a period of a complete year. It should approximate estimates of employment derived from the ALU that use employment from the second year. The second estimate provides an average that will be lower than the first for a firm with less than twelve months of operations, because it calculates an

average over a period greater than the period during which the firm is operating. It should approximate the ALU count for the entry year.

For 2011, the monthly average derived from the PD7 counts is 235,252, compared to the ALU count of 262,475 derived from the second-year employment size of entrants. The second estimate is 138,428, compared to the ALU count using the first-year employment number of 166,580. The LEAP estimates that come from job counts in the T4 files line up closely with those that come from the other major labour statistics program at Statistics Canada, which focuses on PD7 files that are filed monthly.[21] This similarity exists despite the fact that the number of firms filing T4 slips is slightly higher than the number filing PD7s.

A third employment count is available within the agency: the number of employed people that is attached to firms on the Business Register. This information is obtained from PD7s. Unfortunately, it is not placed on the Business Register for all enterprises, is not updated continuously, and does not capture fluctuations over time. A point in time—the second-highest monthly figure derived from a yearly history of PD7s—is used instead.[22] It is therefore incomplete as a total. If it is used for entities that have a positive estimate, it provides an estimate of employment above the other estimates (derived from the T4 files and the complete annual PD7 file), because the Business Register estimate is near the maximum of monthly employment. Employment levels of most production units vary over the year. The actual employment count found on the Business Register for 2011 entrants with an entry in the register was only 130,932. This is far less than either the ALU (full-time equivalent) or the ILU (person–job count).

The different measures of employment produce different estimates of total business-sector employment for 2011. The ALU total is about 11.4 million, the ILU count is about 13.4 million, and the Business Register count is 14.8 million (Table 2). The full-time equivalent count is the lowest, as is normally the case. The ILU count, which more closely measures the number of workers who have a job at any time in the year, is larger. And the Business Register count, which takes a level close to the maximum monthly value and applies it as if this level existed across the entire year, is the largest and least meaningful.

At issue is whether the use of a full-time equivalent as opposed to a job count generates different impressions of the importance of entry. If the first-year size of entrants is used, entrants account for 1.5% of employment using full-time equivalents (ALUs) and 2.3% using person–job counts (ILUs) (Table 1). If the second-year size of entrants is used, the comparable rates are 1.3% and 1.9%.[23] The relative importance of entrants is less when measured using full-time equivalents either because entrants pay lower wages or because they hire more temporary employees than do incumbents.[24]

Using the base definition of entry produces an estimate of 167,000 ALUs (full-time equivalents). If the same exercise is performed after removing enterprises who had employees at some time earlier than the previous year or who had some connection with an ultimate parent possessing other entities, then the impact of entry is reduced to around 135,000 ALUs, or by around 19%. The reduction using ILUs (person–job counts) is from 306,000 to 251,000, or of about 18%.[25]

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21. The labour statistics program that uses the PD7 files does so to produce monthly statistics of jobs.
22. This is done to provide the rough size of firms for surveys that need to choose an adequate sample by size class. It is not designed to approximate any of the usual estimates of employment produced by the agency.
23. These figures compare the level of employment in entrants in their second year to total employment in the first year. The meaning of this ratio is not clear, because the numerator and the denominator apply to different years. It would be more appropriate to use the total employment in the second year, but the ratio would then no longer measure first-year impact. More importantly, these issues suggest that another measure would be even more informative, one that captures the importance of a set of cohorts of different ages at a point in time (1, 2, 3, 4…).
24. Baldwin (1995) reports that entrants in manufacturing paid lower wages than incumbents.
25. If second-year employment sizes were used, the reductions would be about the same in absolute terms, but proportionately smaller. They would be 12% and 13% for ALUs and ILUs, respectively.

4 Conclusion

This paper presents estimates of the importance of entry in Canada using the database underlying the Longitudinal Employment Analysis Program (LEAP), which has produced measures of entry and exit since 1988. It summarizes methodological issues with the way entry is measured, and considers how the base estimates change when other definitions of entry are used. The usefulness of entry or firm creation statistics depends both on the quality of the database used and on the methodology employed to define and measure the importance of entrants.

The entry rates produced by LEAP have several strengths attributable to the underlying data. First, these data are produced from an administrative database of all employers that is comprehensive. Because of their connection to Statistics Canada's Business Register, these administrative data can be reconstituted into meaningful measures of production entities. Second, the database also contains measures of employment or can be used to measure well-defined measures of employment. Finally, production entities can be tracked over time thanks to information on workers that can be linked to each firm and a comprehensive name and address register that is attached to a firm. Discontinuities in production entities that arise from exits and entries can be distinguished from continuous incumbents. The database provides comprehensive coverage and measures of employment that can be cross-referenced to other well-known employment measures that Statistics Canada produces. It also substantially resolves the false positive phenomenon that bedevils administrative databases that are used to measure entry, which often contain identifiers that change even though the underlying production entities do not.

The methodology used to measure entry needs to specify how different issues are handled in defining an entrant. These issues include the following: when a firm should be considered new and therefore an entrant, what production unit should be used to measure entry, what degree of independence should be required in the production entity to define a unit as new, what degree of continuity should be embodied in the definition of a continuous firm as opposed to an entrant, and whether a substantial presence or permanence should be required before a new firm is counted as an entrant.

The LEAP standards in each of these areas are meant to produce statistics that allow for meaningful analysis of the impact of entrants on labour markets in the year of entry. To do so, the standards use employment as a metric to measure importance (in addition to a count of entrants). They choose a measure of the production unit (the enterprise) that allows for the most precise measure of employment. They use a definition of continuity that allows for changes that occur on an annual basis to be measured. They include all entrants who generate new jobs. They do not exclude job-creating production units just because they are owned by ultimate parents that own units in other geographic jurisdictions or in other broadly defined industries.

The program can, however, consider other alternatives when measuring entry. Several have been outlined herein. A degree of permanence can be imposed as a filter to reduce the size of the entry measures. This can be done by limiting the number of entrants to those that last more than one year or have never existed in the past. Similarly, the size of the unit that qualifies as an entrant can be raised from the legal enterprise to the ultimate parent. This paper has shown that changes in both of these areas reduce the entry and employment counts by around 20%. Each of the measures captures a different phenomenon and each can be used to illustrate a different aspect of entry. The strength of LEAP is the ease with which the foundational database can be used to investigate different aspects of the entry process.

Alternatives to the employment measures that are connected to LEAP can also be generated, thanks to the flexibility of the program. They include both a measure of full-time equivalents and a person–job count. Analysts use both to study labour markets, and their availability in LEAP means that diversified analytical needs can be met. The program also has the advantage of a continuous dataset that stretches back to the 1980s, which can be used to investigate long-run

trends. The historical data can also be used to redefine employment measures. For example, rather than entry-year employment, second- or third-year size can be used. Alternatively, analysts can look beyond one-year rates of entry to calculate cumulative rates (the percentage of employment in new enterprises over the last half or full decade). Taken together, these complementary measures provide a rich picture of the extent to which the Canadian economy renews itself.

5 Appendix

5.1 List of CANSIM tables derived from the Longitudinal Employment Analysis Program

National

- 527-0001: Business dynamics measures, by North American Industry Classification System (NAICS)
- 527-0002: Employer businesses in the private sector, by employment dynamics and firm size
- 527-0003: Private sector employment flow rates expressed as a percentage of employment, by North American Industry Classification System (NAICS)
- 527-0004: Private sector employment flow rates expressed as a percentage of employment, by firm size
- 527-0005: Contribution of industries to private sector employment, gross employment creation and gross employment destruction, by North American Industry Classification System (NAICS)
- 527-0006: Contribution to private sector employment, gross employment creation and gross employment destruction, by firm size

Provincial

- 527-0007: Business dynamics measures, by North American Industry Classification System (NAICS), provinces and the territories
- 527-0008: Employer businesses in the private sector, by employment dynamics and firm size, provinces and the territories
- 527-0009: Private sector employment flow rates expressed as a percentage of employment, by North American Industry Classification System (NAICS), provinces and the territories
- 527-0010: Private sector employment flow rates expressed as a percentage of employment, by firm size, provinces and the territories
- 527-0011: Contribution of industries to private sector employment, gross employment creation and gross employment destruction, by North American Industry Classification System (NAICS), provinces and the territories
- 527-0012: Contribution to private sector employment, gross employment creation and gross employment destruction, by firm size, provinces and the territories

5.2 A brief description of the Longitudinal Employment Analysis Program file[26]

5.2.1 Introduction

This guide presents information of interest to users of the Longitudinal Employment Analysis Program (LEAP) database. It is intended to provide researchers with a description of the steps taken to create the LEAP database, including any issues researchers should be aware of before they use the database.

The LEAP file is an administrative databank created by the former Business and Labour Market Analysis Division at Statistics Canada. It was designed to provide longitudinal data on the behaviour of employment levels of Canadian businesses (Baldwin, Dupuy and Penner 1992). The database, which covers the period from 1984 to 2014, uses administrative tax records and data from the Business Register and from the Survey of Employment, Payrolls and Hours (SEPH) to derive the employment profile of businesses over time.

5.2.2 Background, sources and overview of the methodology

The current LEAP file contains annual employment, annual payroll and an industry identifier for every employer in Canada for the years from 1991 to 2014[27] at the national and provincial levels.[28] The file covers both incorporated and unincorporated firms that hire and pay employees in Canada. LEAP is a longitudinal file of enterprises (legal entities in the taxation system), not establishments.[29]

LEAP uses three major inputs: the administrative T4 files from the Canada Revenue Agency (CRA), information from Statistics Canada's Central Frame Database or Business Register, and information from SEPH.

Every employer is required by law to have at least one business number (BN) payroll account with the CRA and to issue a T4 slip (a summary of annual earnings) to each of its employees.[30] A data file is created from this file that links the annual payroll and a count of T4 slips by province of employment to each BN payroll account. These observations, which consist of BN payroll accounts by province are the basic building blocks of LEAP. It is crucial to recognize that BN payroll accounts do not necessarily represent an establishment or an enterprise in the statistical sense used in the Business Register that keeps track of establishment and enterprise structure. A BN payroll account number issued by the CRA for a particular tax entity may span a number of provinces, but statistical establishments cannot. Furthermore, a statistical enterprise may have

26. This description is taken from Lafrance and Leung (2010).
27. The file used to cover a longer time span, back to 1983, but it was based on the Standard Industrial Classification (SIC) of 1980. Once the SIC was converted to the North American Industry Classification System, it was decided to maintain the file from 1991 onward.
28. There is also a file that gives the provincial profiles of every employer. For example, a firm that operates in both Manitoba and Saskatchewan would have two records in the provincial LEAP file. One record would give the employment, payroll and industry for the operations in Manitoba, and the other would give the corresponding information for the Saskatchewan operations.
29. The distinction between enterprise and establishment is not meaningful in most cases, as single-establishment enterprises constitute 99% of businesses in Canada. However, the complex multi-establishment enterprises that make up the remaining 1% of businesses account for roughly one-half of the Canadian economy in terms of total revenue.
30. The earnings represent gross pay before deductions for each employee for the calendar year. They include salaries, wages, overtime pay, piecework and regular commissions, regular incentives, cost of living and other bonuses paid by a firm to its employees for a given period.

one or more BNs and BN payroll accounts. The job of assigning BNs to statistical establishments and enterprises is carried out by the Business Register.

Businesses need to obtain a BN when they open a payroll account, a corporate income tax account, a goods and services tax (GST) account or an import–export account with the CRA. The BN consists of a nine-digit root number identifying the business, followed by a six-digit code identifying the type and number of the account.[31] When a business registers for a new BN, the CRA collects information about its physical location, major business activity and ownership type.[32] The Business Register then determines whether it is a part of an existing enterprise or a new enterprise. If it is a new enterprise, new Business Register identification (BRID) numbers are assigned; the register assigns an identifier for the enterprise, the company, the establishment and the location. The Business Register also determines the industry of each new establishment according to the North American Industry Classification System (NAICS). If the BN is part of an existing enterprise, the register determines how the new entity relates to the structure of the existing enterprise. New BRIDs may be assigned, and changes to the industry classification of the enterprise and establishments within the enterprise may occur.[33]

By linking the observations on BN payroll account from the T4 administrative files to statistical enterprises in the Business Register, LEAP becomes a longitudinal file of enterprises with information on the payroll at both the national and provincial levels.[34] The longitudinal nature of the file allows the birth and death of enterprises to be tracked.[35] The LEAP system performs further methodological verification to ensure that the register's longitudinal linkage of enterprises is reliable. In particular, it uses a labour-tracking process, described in more detail in the next section, to separate false births and deaths from 'real' ones. Whereas real births and deaths reflect the creation of new firms and the failure of existing ones, false births and deaths may simply reflect organizational restructuring within a firm or a change in its reporting practices. The end result of this additional verification process is the assignment to each enterprise of another longitudinal identifier, the Longitudinal Business Register Identifier (called the LBRID), which may differ from the BRID.

The final data source used by LEAP is SEPH. SEPH collects estimates of employment, payrolls and hours on a monthly basis. Employment and earnings data are collected from the payroll accounts administered by the CRA that were described previously, while other variables are obtained using an establishment survey.

LEAP uses this information in two ways.

First, it uses SEPH payroll data to help determine the industry of multi-industry enterprises. While single-industry enterprises simply take on the NAICS code assigned by the Business Register, multi-industry enterprises are given the NAICS code of the establishment with the highest payroll, as reported to the SEPH.

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31. Prior to 1997, the CRA assigned payroll deduction account numbers instead of BNs. The conversion to BNs came about as a result of an initiative of the federal government to simplify the way businesses deal with government. The bringing together of the payroll and income tax information of a business is facilitated by the common nine-digit root across account numbers.
32. The Business Register is continuously updated using administrative files, profiling of complex businesses, surveys and a scan of various publicly available publications.
33. The Business Register also collects information on employment, revenue, assets and geographic location. However, this information is not used directly in the construction of LEAP.
34. In the past, it was not uncommon to find that new BN accounts could not be matched to any enterprise in the Business Register. In these cases, LEAP created a pseudo-BRID. When the Business Register eventually assigned enterprise numbers to the new BNs, the invented BRIDs were replaced by the actual BRIDs. More recently, the Business Register has become more up to date, and unmatched BNs have become rare occurrences.
35. Generally, the birth or entry year of an enterprise is the first year in which it has a payroll, and the death or exit year is the last year in which it has a payroll. Therefore, the age of all enterprises that exist in the first year of the LEAP file is unknown because the year in which they first started to have a payroll is unobserved.

Second, LEAP uses SEPH to calculate a measure of employment for every enterprise called an average labour unit (ALU).[36] While it is possible to count the number of T4 slips associated with each enterprise annually, the T4 slip does not contain information on when and for how long the employee worked for the firm. Therefore, payroll records on the number of T4 slips alone can provide neither the number of people on the payroll at a given point in time, nor the average level of employment over the calendar year. To provide a measure that better captures intensity of employment, a measure (called the ALU) is calculated as the employment an enterprise would have if it had paid its workers the average annual earnings of a typical worker in the enterprise's particular four-digit industry, province and enterprise size class. Average annual earnings are derived using information from SEPH. The number of ALUs for an enterprise is calculated by dividing the annual total payroll of the enterprise by the appropriate average annual earnings, that is:

$$ALU = annual\ total\ payroll\ /\ annual\ average\ earnings.$$

The following subsections discuss the labour-tracking process and the calculation of average annual earnings and ALUs in more detail.

5.2.3 Labour tracking

Since the LEAP file is primarily used to study business and employment dynamics, it is important to separate false firm births and deaths from real ones. Tracking worker movements from one firm to another from year to year allows LEAP to identify many of these false births and deaths.

In order to do so, the records that are considered as deaths are examined first. Each death record has a number of employees associated with it. In the year following the alleged death, these employees may be working for another firm, possibly a new firm or a continuing firm. Since each T4 slip can be associated with a particular individual (via his or her social insurance number [SIN]) and a particular firm (from its BN payroll account number), it is possible to identify the new employer of each employee of the deceased firm. The presence of a cluster of employees from the deceased firm at another firm the following year would suggest that there is a potential relationship between the two firms. This potential relationship is then further investigated by comparing the names and industrial activities of the two firms, and by examining whether the firms share a common BN. If, for example, the firms have similar names, the death is deemed false, and the firm that supposedly died is linked to the new firm by the assignment of the LBRID of the continuing firms. In a similar fashion, new firms are examined to see whether a cluster of their employees can be found in another firm in a previous year.

Labour tracking can lead to many different types of linkages between firms. The simplest is a one-to-one linkage between a death and a birth record. For example, if a business changes from an incorporated to an unincorporated business, the Business Register may remove the original business from the register and create a new one. In this case, the only action necessary is to assign a common LBRID to the two businesses. A more complex case is a merger between two firms, where most employees from the previous two firms are found at the new firm. Here, all three entities are given the same LBRID, and the past records of the two merged firms are combined. The employment of the two firms is added together, and the current NAICS code for the new firm is assigned to the combined, synthetic past records. In other words, the file treats the new merged firm as if it already existed in the past. Similarly, acquisitions and spinoffs can also lead to the combination of firms and the creation of synthetic records.

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36. The LEAP cross-sectional file also contains another measure of employment called an individual labour unit (ILU). Unlike the ALU, this measure is strictly based on payroll records. The number of T4 slips in a given firm is counted. When an individual was not with the firm for an entire year, a ratio is assigned to that individual based on his or her total earnings for a year. For example, if an individual worked in Firm A for six months of the year and earned $40,000 and worked in Firm B for the rest of the year earning $60,000, Firm A will be assigned an ALU of 0.46.

5.2.4 Average labour unit methodology

Since enterprise employment data by province for all industries are not readily available, a methodology was developed to translate the payroll of the enterprise into the annual average employment-equivalent.[37] The ALUs of an enterprise represent its annual average employment if it paid its workers the average annual earnings typical in its particular four-digit industry, province and employment size class. Ideally, the average annual earnings of workers in each enterprise should be used, but such data are not available.

Derived using data from SEPH, the calculation of the average annual earnings (AAE) requires several steps:

Step 1

Total T4 payroll and SIN counts from the CRA are calculated for each combination of province and four-digit NAICS category, and for each combination of province, four-digit NAICS category and enterprise SIN-count size class (1 to 19, 20 to 49, 50 to 199, and 200 and over).[38]

Step 2

Preliminary average annual earnings ($pAAE$) are calculated for each combination of province and industry and for each combination of province, industry and size by dividing T4 payroll by the corresponding SIN head counts, as follows:

$$pAAE_{prov,ind} = \frac{T4\ payroll_{prov,ind}}{SIN\ count_{prov,ind}}$$

and

$$pAAE_{prov,ind,size} = \frac{T4\ payroll_{prov,ind,size}}{SIN\ count_{prov,ind,size}}.$$

Step 3

The final average annual earnings at the province and industry level are then calculated by using SEPH employment rather than SIN head counts. Lastly, final average annual earnings at the province, industry and size level are obtained by taking the final average annual earnings at the province and industry level and multiplying them with the corresponding preliminary average annual earnings by province, industry and size, divided by preliminary average annual earnings by province–industry ratio, as follows:

$$AAE_{prov,ind} = \frac{T4\ payroll_{prov,ind}}{Employment^{SEPH}_{prov,ind}}$$

37. SEPH does not cover enterprises in agriculture, fishing and trapping, private household services, religious organizations and military personnel of defence services. Furthermore, monthly employment from SEPH for complex enterprises cannot be easily split across provinces.

38. For example, take a complex enterprise with an aggregate SIN count of 20, and a SIN count of 11 and annual payroll of $500,000 in Manitoba in manufacturing. The enterprise also has a SIN count of 9 and annual payroll of $400,000 in Saskatchewan in wholesale trade. This enterprise would contribute $500,000 to the payroll of the category of Manitoba and manufacturing and to the category of Manitoba, manufacturing and firm size of 20 to 49. It would also contribute $400,000 to the payroll of the category of Saskatchewan and wholesale trade and to the category of Saskatchewan, wholesale trade and firm size of 20 to 49. Similarly, this enterprise would contribute 11 to the SIN count of the category of Manitoba and manufacturing and to the category of Manitoba, manufacturing and firm size of 20 to 49. It would also contribute 9 to the SIN count of the category of Saskatchewan and wholesale trade and to the category of Saskatchewan, wholesale trade and firm size of 20 to 49. In these calculations, individual T4 slips with earnings under $75 or over $250,000 are ignored, for both payroll and SIN counts.

and

$$AAE_{prov,ind,size} = AAE_{prov,ind} \frac{pAAE_{prov,ind,size}}{pAAE_{prov,ind}}.$$

The ALUs for a particular enterprise are calculated in a two-step procedure.

Step 1

The provincial payrolls of the enterprise are divided by the appropriate province–industry average annual earnings. These preliminary provincial ALUs are then summed to arrive at a preliminary national ALU ($pALU$), as follows:

$$pALU_f = \sum_{prov} \frac{T4\ payroll_{f,prov,ind}}{AAE_{prov,ind}},$$

where f indexes firms. The preliminary national ALU of the enterprise is used to determine the size class of the enterprise.

Step 2

Final provincial ALU estimates are then obtained by dividing the provincial payrolls of the enterprise by the appropriate average annual earnings for province, industry and size class. The final ALU estimate at the national level is again the sum of provincial ALU estimates, as follows:[39]

$$ALU_f = \sum_{prov} \frac{T4\ payroll_{f,prov,ind}}{AAE_{prov,ind,size}}.$$

The LEAP ALU estimates are compared with the SEPH employment estimates and the Labour Force Survey estimates for the period from 1999 to 2004. The general trends exhibited by LEAP and SEPH are very similar at the major industry group level. For many industries, LEAP closely matches not just the SEPH employment trends, but also the levels. The exception is public administration.

39. As in the calculation of average annual earnings, enterprises that operate in a number of provinces can have a different industry classification in each province, but their size class is a national characteristic.

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Further reading

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